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REMARKS

Claims 1-23 are pending in the present Application. Claim 2 has been amended, leaving Claims 1-23 for consideration upon entry of the present submission. No new matter has been introduced by way of amendment.

Reconsideration and allowance of the claims are respectfully requested in view of the above amendments and the following remarks.

Claim Rejection Under 35 U.S.C. § 112, Second Paragraph

Claim 2 stands rejected under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. In particular, Claim 2 allegedly fails to further limit the method of Claim 1 because SWNTs are understood to be single walled carbon nanotubes. Applicant respectfully traverses this rejection.

Applicant has amended Claim 2 to clarify that the SWNTs of Claim 1 include carbon nanotubes that, as stated in paragraph [0017] of the original Specification, “may have a number of other atoms such as boron, nitrogen, and the like”, whereas the SWNTs of Claim 2 consist of carbon.

Accordingly, Applicant respectfully requests reconsideration and withdrawal of the rejection applied to Claim 2 under 35 U.S.C. § 112, second paragraph.

Claim Rejections Under 35 U.S.C. § 103(a)

Claims 1-23 stand rejected under 35 U.S.C. § 103(a), as allegedly unpatentable over United States Patent No. 6,669,918 to Schleier-Smith *et al.* (hereinafter “Schleier-Smith”) in view of United States Patent Nos. 6,187,823 and 6,368,569 to Haddon *et al.* (hereinafter “the Haddon patents”). The Applicant respectfully traverses this rejection.

For an obviousness rejection to be proper, the Examiner must meet the burden of establishing a *prima facie* case of obviousness. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988). Establishing a *prima facie* case of obviousness requires that all elements of the invention be disclosed in the prior art. *In Re Wilson*, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970). The Applicant

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asserts that a *prima facie* case of obviousness has not been established because the cited references fail to teach or suggest all elements of Applicant's independent Claims 1, 14, and 19.

Independent Claim 1 is directed to a method of separating *met*-SWNTs from *sem*-SWNTs comprising suspending a population of functionalized SWNTs in a suspending solvent, and employing a means for inducing selective precipitation, wherein selective precipitation comprises precipitating a majority of the *met*-SWNTs while leaving a population of the *sem*-SWNTs in suspension, or precipitating a majority of the *sem*-SWNTs while leaving a population of the *met*-SWNTs in suspension.

Independent Claim 14 is directed to a method for selective extraction of *sem*-SWNTs from a mixture of *sem*-SWNTs and *met*-SWNTs, comprising contacting a population of non-acid functionalized SWNTs with an surfactant amine, to form a population of surfactant amine functionalized *sem*-SWNTs and extracting the population of surfactant amine functionalized *sem*-SWNTS with a means for solvent extraction while leaving a majority of the *met*-SWNT behind.

Independent Claim 19 is directed to a method of separating *sem*-SWNTs or *met*-SWNTs by diameter to form a diameter-separated population of *sem*-SWNTs or *met* SWNTs, comprising suspending an enriched population of functionalized *sem*-SWNTs or an enriched population functionalized *met*-SWNTs in a suspending solvent to form a functionalized *sem*-SWNT suspension or a functionalized *met*-SWNT suspension, and employing a means for selectively precipitating according to diameter the functionalized *sem*-SWNTs or functionalized *met*-SWNTs, wherein the enriched population of functionalized *sem*-SWNTs comprises greater than or equal to about 66 wt% *sem*-SWNTs or the enriched population of functionalized *met*-SWNTs comprises greater than or equal to about 66 wt% *met*-SWNTs.

With respect to independent Claims 1 and 19, as well as those claims dependent therefrom, there is no mention or suggestion, by the cited references, of at least *selective precipitation* of the nanotubes. Schleier-Smith is directed to methods for bulk separation of single walled tubular fullerenes based on chirality. Specifically, Schleier-Smith makes use of a template that has a plurality of openings, which are oriented to energetically favor *adsorption* of single-walled fullerenes having a specific chirality. As stated in the Abstract as well as numerous throughout Schleier-

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Smith, the template is exposed to a suspension of single walled tubular fullerenes of random chiralities for *adsorption* of single walled tubular fullerenes of the selected chirality into the openings of the template. The Applicant contends that adsorption based on angular orientation is markedly different than selective precipitation based on solubility.

The Haddon patents fail to compensate for the deficiencies of Schleier-Smith. The Haddon patents are directed to methods for solubilizing carbon nanotubes. While the Haddon patents disclose the separation of single walled carbon nanotubes from impurities (e.g., metal catalysts, nanoparticles, graphite, amorphous carbon, fullerenes, and other contaminants), the Haddon patents do not disclose or suggest separation of the different types of single walled carbon nanotubes from each other. In fact, the Haddon patents focus only on the solubilization of single walled carbon nanotubes in general, and fail to distinguish between the different types of single walled carbon nanotubes altogether. Thus, the Haddon patents and Schleier-Smith, individually or in combination, fail to establish a *prima facie* case of obviousness against Claims 1 and 19, as well as those claims that depend therefrom.

Turning now to Claim 14, the Applicant asserts that there is no disclosure or suggestion by Schleier-Smith and/or the Haddon patents of at least "contacting a population of non-acid functionalized SWNTs with a surfactant amine, to form a population of surfactant amine functionalized *sem*-SWNTs". The Examiner states, on Page 3 of the present Office Action, that the "SWNTs are functionalized by action of acid or base compound and surfactant (column 5, lines 12-24). However, the Applicant contends that the functionalized SWNTs that are contacted with the surfactant amine are indeed acid functionalized and not *non-acid functionalized SWNTs* as presently claimed. The Examiner's attention is respectfully directed to the Specification of Schleier-Smith, the relevant portions of which are reproduced for convenience as shown below.

Raw fullerene nanotubes usually are produced in the form of long, tangled ropes of many nanotubes, which are held in close contact by strong electrostatic van der Waals interactions. As is well known in the art, **the nanotube ropes can be separated and cut to form individual shorter open-end tubular fullerenes by sonication in a 3:1 mixture of concentrated sulfuric and nitric acids (98% and 70%, respectively) at 40° Centigrade. The thus produced "fullerene pipes" are more manipulable and better suited for use in molecular electronics, and for being**

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functionalized to improve the solubility thereof, as will be discussed in following paragraphs.

(Schleier-Smith; column 4; lines 25-36; emphasis added)

The solubility of the tubular fullerenes may be enhanced by functionalizing the tubular fullerenes with long-chain amines. Tubular fullerenes 100', end-functionalized with amide groups, as illustrated schematically in FIG. 5, are disclosed in Hamon, et al., "Dissolution of Single-Walled Carbon Nanotubes," *Advanced Materials*, Vol. 11, No. 10, 1999, and provide enhanced solubility without impairing deposition of the tubular fullerene on the template 40. Similar end functionalization is described in U.S. Pat. No. 6,187,823. Side functionalization of the tubular fullerenes also may provide the desired enhanced solubility thereof, without disturbing the self-orienting deposition character of the fullerenes.

(Schleier-Smith; column 5; lines 12-24; emphasis added)

The Applicant points out that the "tubular fullerenes" that are discussed in the passage cited by the Examiner (i.e., column 5, lines 12-24) are produced by sonicating raw (i.e., as-produced or non-functionalized) fullerene nanotubes in a mixture of acids as described in the first passage reproduced above. Accordingly, the fullerene nanotubes that are contacted with the surfactant amine are acid functionalized and not non-acid functionalized as claimed.

Like Schleier-Smith, the Haddon patents both make use of acid functionalization, prior to contacting the SWNTs with a surfactant amine to form a population of surfactant amine functionalized SWNTs. For example, United States Patent No. 6,368,569, discloses (e.g., in column 2, lines 9-16) that the novel and improved method of dissolving carbon nanotube metals and semiconductors comprises terminating the carbon nanotubes with carboxylic acid groups, followed by attaching an aliphatic carbon chain to the ends of the carbon nanotubes to render them soluble in a particular organic solvent. Similarly, United States Patent No. 6,187,823, discloses (e.g., in column 2, lines 9-20) that the novel and improved method of dissolving single walled carbon nanotube metals and semiconductors comprises terminating purified single walled carbon nanotubes with carboxylic acid groups, reacting the carboxylic acid groups with an amine or an alkylaryl amine, and dissolving the reacted single walled carbon nanotubes in the particular organic solvent.

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Thus, the Haddon patents and Schleier-Smith, individually or in combination, fail to establish a *prima facie* case of obviousness against Claim 14 and the claims that depend therefrom.


In view of the foregoing, Applicant respectfully requests reconsideration and withdrawal of the rejection applied to Claims 1-23 under 35 U.S.C. § 103(a).

It is believed that the foregoing remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicant. Accordingly, reconsideration and allowance are requested.

If there are any additional charges with respect to this submission or otherwise, please charge them to Deposit Account No. 06-1130.

Respectfully submitted,

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